OXC-0573
COPY 2 OF 3

LOCKHEED AIRCRAFT CORPORATION

Inter-Departmental Communication

To: All Concerned

2 May 1960

DOCUMENT NO. 96
NO CHANGE IN CLASS.
☐ DECLASSIFIED
CLASS. CHANGED TO: TS (S) C
NEXT REVIEW DATE: 2012
AUTH: HR 70-2
DATE: 5 Feb 82 REVIEWER: [redacted]

STAT

From: Clarence L. Johnson

Subject: OVER-ALL SAFETY, A-12 AIRCRAFT

While all of you are aware of the great problem we have in building the A-12 aircraft to travel at the very high speeds and altitudes involved, I want to point out some of the problems regarding safety which you must consider in every aspect of design and operation. These will be only a few typical examples of problems. When you encounter anything of an unusual safety nature in the aircraft, which should be called to the attention of everyone, do not hesitate to tell [redacted] STAT

STAT [redacted] or me.

The following are examples of problems:

1. Engine Installation.

The engine installation is extremely critical from the point of view of safety. We have never had an installation of such great power and running at such high temperatures as in this airplane. The take-off fuel consumption is over 60,000 pounds of fuel per hour per engine. To pump this amount through aluminum lines, around a hot afterburner subject to pressure surges from fast throttle movement, we must have the world's best aircraft plumbing to avoid fires. In flight, the engine is "cooled" by air that is running over 800°F in temperature. The rear end of the power plant installation is "cooled" by air which at that point has been heated up to about 1200°F.

To avoid leaks in the engine fuel system, the engine manufacturer is going to welded or brazed joints throughout the whole engine installation. We will do an appropriate amount of this ourselves, throughout the aircraft. The hydraulic system, with the large 40-gallon per minute pumps, is circulating a great deal of inflammable fluid at extremely high pressure. Part of it goes to the rudder boosters, located directly above a white hot engine section. Leaks in this area would almost certainly be fatal.

Electric wiring, in the nacelle particularly, is subject to the same high temperatures. Normal insulations will not take the temperatures, and the resistive characteristics of the wire are adversely affected by temperature. Every pulley and cable in the nacelle is subjected not only to high temperatures and stresses but to a noise field which varies from 140 to 180 dbs.

We are using a pyrophoric ignition system to provide lights at altitude. This fluid immediately bursts into flame upon exposure to air, even at pressures as low as one-half pound per square inch absolute. The flame that develops cannot be put out by water, foam, or any normally available extinguishing agent. If a leak develops while charging the tank, there is immediate fire. Even covering a flame with 4 inches of sand does not prevent re-ignition if the sand is stirred up. I cannot impress upon you too much the need for the world's most excellent design, to provide us with satisfactory fire safety.

Control of the inlet spike must be precise and rapid. There are some indications that, if the engine blows, we will lose thrust in terms of hundredths of a second. When this occurs under certain design conditions, extremely high loads will be developed in the vertical surfaces. It happens so rapidly that we are depending on automatic control to keep the airplane straight and intact.

2. Control System

For the first time, we are depending to a very high degree upon artificial stability about the pitch axis. The integrity of the booster system and the associated augmentors and autopilot gear determines, to a large degree, the success of the aircraft. We are doubling up and tripling up, at great expense and weight, critical items of the control system, with full knowledge of this fact, but the best conception in the world can be readily defeated by questionable or improper detail design.

3. Structure

We are the first to use the new B120 titanium material in an aircraft. While we have instituted what is probably one of the world's best material screening procedures, to assure the use of good materials and processes, we face extreme problems from high loads, aeroelastic deflections, and high temperatures, both of a transient and steady nature. We are exploiting a strong, brittle material close to its limits in certain areas, because of the combined stress and temperature factors. While we will do everything possible, testing half an airplane in a cold static test and many sections at temperature, we will not really know where we stand structurally until we have progressed into the early flight tests. Certain sections of the aircraft are made of material other than B120. These areas must be designed so that failure of the parts will not be catastrophic. This will apply in all cases except the vertical tail.

4. Landing Gear.

We are developing an airplane which will have rolling speeds on the ground of between 250 and 300 mph. At the same time, we are using titanium material highly stressed, in units critical in weight, and carrying a minimum amount of steel for brakes. We are greatly dependent on the infallible operation of the drag chute, as well as the total integrity of the gear itself. The landing gear troubles being encountered by all the large transports should be an ample lesson to us, in terms of designs for fatigue and dynamic loads.

5. Air Conditioning.

Problems of the air conditioning system and its need for reliability are quite obvious. We have taken major steps to dual up the air conditioning system itself, the oxygen system, and the lines to the pilot's suit, to provide him with two nostrils and two lungs; but, in the end, he has only one heart. We have had an ample lesson in the problems of safety having to do with pressure suits and oxygen on the U-2, where half our fatal crashes have been due to these two factors. There are no excuses for our not having the best air conditioning system in the world on this airplane, considering our over-all background in the field.

6. Navigation and Communication Gear

Due to the very high speed of the A-12, it is imperative that reliable navigation and communication gear be provided. One can become "awful lost" at a speed of 35 miles per minute, not knowing in which direction to point the beast. While we have excellent range capabilities, the human factor of time is of even more importance. Our design reserves are low. We cannot have the many failures of radio communication gear and navigation gear that we have accepted for years, going back to the DC-3. For this reason, we are providing several means of navigation, but it is doubtful whether we have provided enough means to keep up with the extreme performance of the airplane.

7. Payload Equipment

When all is said and done, if we do not have reliable gear in the equipment bay, the whole effort is for naught. We are taking great pains, going to huge expense, and expending tremendous human effort and courage to get this one-half of one per cent of the aircraft gross weight up into the air. We would be extremely foolish to accept poor reliability on the gear for which the project is being carried out.

I would like to point out that approximately 25% of the initial orders of the B-58, F-104, F-100, and F-101 airplanes have been lost due to accidents. We cannot accept anything like this ratio on the A-12.

I am circulating this memo to you one at a time, to be sure that every man on the project having to do with design, and certain of those who have inspection, manufacturing and flight test responsibilities, will better understand the nature of his responsibilities.

Clarence L Johnson

Clarence L. Johnson
Vice President
Advanced Development Projects

CLJ:vmp